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Publication number:

**0 665 651 A3**

(12)

## EUROPEAN PATENT APPLICATION

(21) Application number: 95300129.4

(51) Int. Cl.<sup>8</sup>: H03L 7/197, H03L 7/183

(22) Date of filing: 10.01.95

(30) Priority: 31.01.94 US 189521

(43) Date of publication of application:  
02.08.95 Bulletin 95/31

(84) Designated Contracting States:  
DE FR GB IT

(88) Date of deferred publication of the search report:  
08.11.95 Bulletin 95/45

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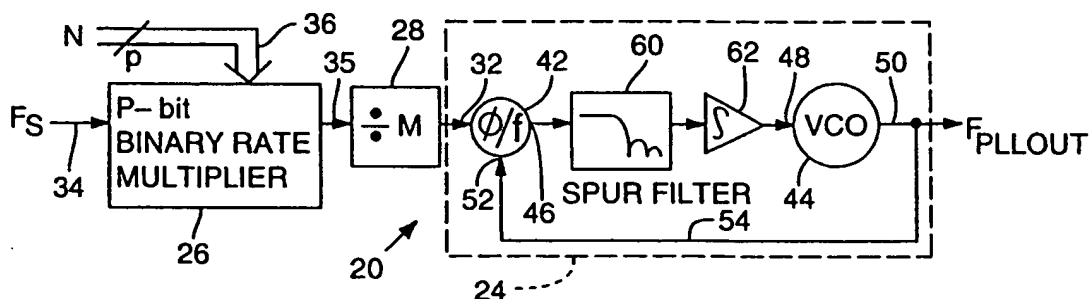
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(54) Phased locked loop synthesizer using a digital rate multiplier reference circuit.

(57) A phase locked loop synthesizer (20) for generating a digitally programmable, continuous wave signal comprises a rate multiplier (26) and divider (28) connected in a reference signal path to a phase detector (42). The rate multiplier and divider generate a reference signal which is programmable to any of a set of regularly spaced frequencies having exact decimal representations. The divider limits the

peak-to-peak phase deviation of the rate multiplier. The phase detector locks a synthesized signal generated by a variable frequency oscillator (44) to the phase of the programmed reference signal. A spur filter (60) connected to the phase detector output (46) reduces spurious frequencies in the phase detector output.

FIG. 1



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# EUROPEAN SEARCH REPORT

Application Number  
EP 95 30 0129

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 965 533 (GILMORE) 23 October 1990 * column 2, line 30 - line 48 * * column 5, line 14 - column 8, line 54; figure 2 *	1,2	H03L7/197 H03L7/183
A	---	5,6,8	
X,P	EP-A-0 630 129 (ALCATEL SEL AG) 21 December 1994 * page 6, line 37 - line 52; figure 8 *	1,2	
Y	US-A-3 651 422 (M. J. UNDERHILL) 21 March 1972 * column 1, line 73 - column 4, line 23; figures *	1,2	
A	---	5,8	
Y	RADIO AND ELECTRONIC ENGINEER, vol. 48, no. 3, March 1978 LONDON GB, pages 127-132, L. K. REGENBOGEN 'A LOOSE-LOCKED OSCILLATOR' * the whole document *	1,2	
A	---	5-7	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H03L
Y	PATENT ABSTRACTS OF JAPAN vol. 9 no. 99 (E-311), 27 April 1985 & JP-A-59 225619 (NIPPON DENKI KK) 18 December 1984, * abstract *	5,8	
A	---	1,2	
Y	OSBERMAN R. M. M. 'Electronic counters' 1973, MAC MILLAN, LONDON, GB * page 198 - page 208; figures 9.8-9.12 * ---	5,8	
	--- -/--		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 September 1995	Examiner Balbinot, H
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## EUROPEAN SEARCH REPORT

Application Number  
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-3 297 953 (EVAN T. COLTON) 10 January 1967 * column 2, line 27 - column 6, line 63; figures * -----	1,2,5,8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
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<b>CATEGORY OF CITED DOCUMENTS</b>			
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